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Preemergent Weed Control in Container-grown Herbaceous Perennials[1]

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Abstract

This study was conducted to evaluate several preemergence herbicides for weed control, effects on plant growth, and phytotoxicity to container-grown herbaceous perennials. Surflan (Oryzalin) was applied at 0, 2.24, 4.48, 6.72 kg ai/ha (0, 2, 4, 6 lb ai/A), Ronstar (Oxadiazon) at 0, 4.48, 8.96, 13.44 kg ai/ha (0, 4, 8, 12 lb ai/A), and Rout (Oxyfluorfen + Oryzalin) at 0, 3.36, 6.72, 10.08 kg ai/ha (0, 3, 6, 9 lb ai/A) to container-grown *Ajuga reptans atropurpurea* L. (carpet bugle), *Campanula garganica major* (Ten.) Fiori (bellflower), and *Liatris spicata* (L.) Willd. (spike gayfeather). Additionally, Devrinol (Napropamide) and Treflan (Trifluralin) were each applied at 0, 4.48, 8.96, 13.44 kg ai/ha (0, 4, 8, 12 lb ai/A) to *Astilbe* × *arendsii* Arends. (false spirea) and *Dicentra spectabilis* (L.) Lem. (bleeding heart). Plants were grown in 2.54 l (#1) containers in a medium of sand, topsoil, and sphagnum peat (1:1:1 by vol). Weed control was acceptable with all herbicides except Surflan at 2.24 kg ai/ha (2 lb ai/A) which did not control shepardspurse. Surflan applied at either 4.48 (4 lb ai/A) or 6.72 kg ai/ha (6 lb ai/A) rate resulted in phytotoxicity of carpet bugle, while the 6.72 kg ai/ha rate (6 lb ai/A) significantly reduced plant growth.

Index Words: herbaceous perennials, herbicides, weed control

Herbicides used in this study: Oxadiazon (Ronstar) 3−{2,4-dichloro-5-(1-methylethoxy)phenyl}-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one; Oryzalin (Surflan) 3,5-dinitro-N^4,N^4-dipropylsulfanilamide; Oxyfluorfen + Oryzalin (Rout) 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4(trifluoromethyl) benzene + 3,5-dinitro-N^4,N^4-dipropy sulfanilamide; Napropamide (Devrinol) N,N-diethyl-2-(1-naphthalenyloxy)-propionamide; Trifluralin (Treflan) a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine

Species used in this study: carpet bugle (*Ajuga reptans atropurpurea*), bellflower (*Campanula garganica major*), spike gayfeather (*Liatris spicata*) false spirea (*Astilbe* × *arendsii*), bleeding heart (*Dicentra spectabilis*)

Introduction

Homeowners are rapidly discovering that herbaceous perennials are very useful in the landscape. This interest has caused a significant increase in production and sales of perennials during the past several years (7). Herbicides are quickly becoming the preferred method of weed control for producers of container-grown landscape plants. Herbicides can reduce costs to 10% hand-weeding (2).

Extensive research has been conducted on tolerance of container-grown woody landscape plants to herbicides (3, 5, 6, 8, 9), but there are only a few herbicides labeled for use with herbaceous perennials. Even among these, researchers have found considerable variation in the response of perennials to preemergence herbicides (1). The objectives of this study were to determine effects of herbicides on several herbaceous plant species and to determine weed control effectiveness.

Materials and Methods

This study was conducted during the growing seasons of 1986 and 1987. Plant material used in 1986 were 5.6 cm (2.2 in) liners of carpet bugle, bellflower, and spike gayfeather. Bareroot false spirea and bleeding heart were used in 1987. Plants were shifted into 2.54 l (#1) containers April 12, 1986 and March 4 and 5, 1987. Growing medium was composed of topsoil, sand, and sphagnum peat (1:1:1 by vol). Plants were topdressed with 15 g per container Sierrablend 17N-2.85P-8.3K (17-6-10) plus micronutrients fertilizer and grown on 60 cm (2 ft) centers.

Approximately 6-8 seeds of each weed species were sown on the container medium surfaces June 2, 1986 and May

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19, 1987. Species used in 1986 were redroot pigweed (*Amaranthus retroflexus* L.), European woodsorrel (*Oxalis europaea* Jordan), shepardspurse (*Capsella bursa-pastoris* (L.) Medik.), annual bluegrass (*Poa annua* L.), barnyardgrass (*Echinochloa crusgali* (L.) Beauv.), and yellow foxtail (*Setaria glauca* (L.) Beauv.). In 1987, common chickweed (*Stellaria media* (L.) Vill.) and common groundsel (*Senecio vulgaris* L.) were substituted for redroot pigweed and yellow woodsorrel.

Herbicides were applied four days after weed seeds were sown. Herbicide rates and formulations are listed in Table 1. All herbicides were applied by hand to individual containers. Two controls were also used to observe the effects of weed competition on container-grown herbaceous perennials. The weedy control had weed seeds sown without herbicide, and the weed-free control had no weed seeds sown or herbicide applied. All plants were irrigated with approximately 1.3 cm (0.5 in) water immediately following herbicide application.

Data were collected throughout the growing seasons. The number and species of weeds present in each container were counted. Total height of each plant was determined by subtracting height of the plant when herbicides were applied from height measured at harvest. Total width was determined in the same manner. Phytotoxicity evaluation was made by visual observation on a scale of 1 to 5, where 1 = slight yellowing, and 5 = severe stunting, necrosis, and dieback. Plants were harvested September 22, 1986 and August 18, 1987 by cutting them off at gound level and drying above-ground biomass.

Experimental design was a randomized complete block. Analysis of data was calculated at the .05 level of significance and significant means separated by Tukey's *w* procedure.

Table 1. Herbicide formulations and rates applied.

Herbicide/Formulation	rate	kg ai/ha	lb ai/A
Devrinol 5% G (Napropamide)	1×	4.48	4.0
	2×	8.96	8.0
	3×	13.44	12.0
Surflan 40.4% AS[z] (Oryzalin)	1×	2.24	2.0
	2×	4.48	4.0
	3×	6.72	6.0
Ronstar 2% G (Oxadiazon)	1×	4.48	4.0
	2×	8.96	8.0
	3×	13.44	12.0
Rout 3% G (Oxyfluorfen + Oryzalin)	1×	3.36	3.0
	2×	6.72	6.0
	3×	10.08	9.0
Treflan 5% G (Trifluralin)	1×	4.48	4.0
	2×	8.96	8.0
	3×	13.44	12.0

[z]Applied in 60 l H_2O/ha (40 gal/A)

Results and Discussion

The weedy and weed-free controls demonstrated the effects of weed competition on plant growth and the effectiveness of herbicides applied. Since results of new plant growth (height and width) were very similar to results obtained from dry weights, only dry weight data are presented. The presence of weeds significantly decreased dry weights of all perennials except bleeding heart (Table 2). Herbicide rate treatments had no significant detrimental effect on dry weight of false spirea, bellflower, bleeding heart, or spike gayfeather.

The 6.72 kg ai/ha (6 lb ai/A) rate of Surflan treatment resulted in a significantly lower dry weight of carpet bugle than the 2.24 kg ai/ha (2 lb ai/A) rate (Table 3). Both the 4.48 kg ai/ha (4 lb ai/A) and 6.72 kg ai/ha (6 lb ai/A) rates of Surflan resulted in commercially unacceptable plant quality.

Phytotoxicity was observed approximately 10 weeks after herbicide application as a slight chlorosis of the foliage. The 2× Surflan treatment resulted in an average visual rating of 2 on three of the test plants. At harvest this treatment resulted in an average rating of 2.5 on all six plants receiving this treatment. Symptoms of the 3× Surflan treatment progressed gradually from an average initial rating of 3.2 to 4.7 at harvest. Other researchers have observed similar reductions in plant growth as a result of Surflan application (1, 4, 7). No other herbicide resulted in injury to the other herbaceous perennial species evaluated.

No broadleaved weeds germinated in carpet bugle, false spirea, or bleeding heart with any herbicide treatment. Growth of these weeds in carpet bugle could have been suppressed by the dense growth habit of the plant. Partial shade requirements of false spirea and bleeding heart probably contributed to the absence of broadleaved weeds.

Shepardspurse was the dominant weed present in containers of bellflower and spike gayfeather. This species made up 95% of the total percentage of broadleaved weeds in bellflower at the 2.24 kg ai/ha (2 lb ai/A) Surflan treatment

Table 2. Mean dry weights (grams) per treatment of five container-grown perennials as influenced by rate of herbicide.

Rate	Species				
	carpet bugle	false spirea	bellflower	bleeding heart	spike gayfeather
weed-free control	28.61 a[z]	22.15 a	12.36 a	14.66 a	8.11 a
weedy control	21.45 b	18.15 b	4.78 b	13.60a	2.36 b
1×[y]	28.01 a	21.88 ab	10.32 a	14.88 a	6.22 a
2×	26.63 a	20.46 ab	11.81 a	14.94 a	4.95 a
3×	18.24 b	19.62 ab	11.08 a	14.62 a	7.02 a
$HSD_{0.05}$	5.13	3.51	3.62	3.17	5.91

[z]Means in a column followed by the same letter(s) are not significantly different at the 5% level.

[y]Rate represents all herbicides applied. Rates of individual herbicides are converted from kg ai/ha in Table 1 for clarity.

Table 3. Mean dry weights (g) per treatment of carpet bugle as influenced by rate and herbicide.

Treatment	dry weight
Weed-free control	28.60 a[z]
Weedy control	21.25 ab
1×	
3.36 kg ai/ha Rout	28.33 a
4.48 kg ai/ha Ronstar	29.44 a
2.24 kg ai/ha Surflan	25.76 a
2×	
6.72 kg ai/ha Rout	30.46 a
8.96 kg ai/ha Ronstar	29.35 a
4.48 kg ai/ha Surflan	20.07 ab
3×	
10.08 kg ai/ha Rout	21.68 a
13.44 kg ai/ha Ronstar	20.94 a
6.72 kg ai/ha Surflan	12.12 b
$HSD_{0.05}$	11.16

[z]Means in a column followed by the same letter(s) are not significantly different at the 5% level.

and was the only weed present at the 4.48 kg ai/ha (4 lb ai/A) rate (Table 4). Surflan is not labeled to control shepardspurse; therefore, these results were not unexpected. However, control was achieved as rate of application increased. Although the quantity of weeds present were not statistically significant between any treatments, this large number would be considered commercially unacceptable. Shepardspurse made up more than 99% of the broadleaved weeds present at the 2.24 kg 1./ha (2 lb ai/A) rate of Surflan in spike gayfeather (Table 5).

Significant quantities of grass weeds resulted only in the weedy control of the five herbaceous perennials tested.

Significance to the Nursery Industry

The results of this study show that herbicides can be used effectively and safely in container-grown herbaceous perennials. None of the herbicides evaluated caused injury when applied at the manufacturers' recommended rate. Surflan should not be applied to container-grown carpet bugle at higher than the manufacturer's recommended rate. This results in a problem in that if shepardspurse is a weed in container-grown perennials, Surflan must be applied at rates higher than 2.24 kg ai/ha (2 lb ai/A) to provide adequate control.

(Ed. Note: This paper reports the results of research only and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.)

Table 4. Mean number of broadleaved weeds and shepardspurse per treatment in bellflower as influenced by herbicide and rate.

Treatment	number of broad-leaved weeds	number of shepardspurse
Weed-free control	0 a[z]	0 a
Weedy control	19.7 a	15.6 a
1×		
3.36 kg ai/ha Rout	0 a	0 a
4.48 kg ai/ha Ronstar	0.2 a	0 a
2.24 kg ai/ha Surflan	26.2 a	25.0 a
2×		
6.72 kg ai/ha Rout	0 a	0 a
8.96 kg ai/ha Ronstar	0 a	0 a
4.48 kg ai/ha Surflan	5.0 a	5.0 a
3×		
10.08 kg ai/ha Rout	0 a	0 a
13.44 kg ai/ha Ronstar	0 a	0 a
6.72 kg ai/ha Surflan	0 a	0 a
$HSD_{0.05}$	27.87	27.04

[z]Means in a column followed by the same letter(s) are not significantly different at the 5% level.

Table 5. Mean number of broadleaved weeds and shepardspurse per treatment in spike gayfeather as influenced by herbicide and rate.

Treatment	number of broad-leaved weeds	number of shepardspurse
Weed-free control	0 a[z]	0 a
Weedy control	88.9 a	87.4 a
1×		
3.36 kg ai/ha Rout	0 a	0 a
4.48 kg ai/ha Ronstar	0 a	0 a
2.24 kg ai/ha Surflan	267.3 b	267.0 b
2×		
6.72 kg ai/ha Rout	0 a	0 a
8.96 kg ai/ha Ronstar	0 a	0 a
4.48 kg ai/ha Surflan	0 a	0 a
3×		
10.08 kg ai/ha Rout	0 a	0 a
13.44 kg ai/ha Ronstar	0 a	0 a
6.72 kg ai/ha Surflan	0 a	0 a
$HSD_{0.05}$	157.98	159.39

[z]Means in a column followed by the same letter(s) are not significantly different at the 5% level.

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